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SUBJECT Brown Coal Deposits in the Zholkva-Rava Ruska Area of the Ukraine 25X1

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General Morphological and Geological Outline

1. The area of brown coal in the vicinity of Zohlkva and Rava Ruska extends into the Rostotchia Hills, which are 10 to 12 kilometers (about 7.45 miles) wide and elevated 70 to 80 meters (about 230 to 262 feet) above the adjacent plains -- the Buh River Plain on the east and the Sian River Plain on the west. The Rostotchia Hills spread from the Kamula peak (elevation 473 meters) near Bibrka toward Lwow (Wysoky Zamok, 413 meters), Zholkva (Wowcha, 369 meters), Rava Ruska (Kaminka, 349 meters), and Tomaszlv (Dibrova, 271 meters). Despite its small relative elevation, this range of hills is yet quite a remarkable hindrance to the northwest winds, which carry atmospheric moisture from the Atlantic Ocean. This causes an abundant precipitation on the western slopes of the Rostotchia Hills, resulting in luxuriant forests and a large storage of ground water. The latter gives rise to numerous springs, which in turn are the sources of many streams and rivers.

2. The eastern slopes of the Rostotchia Hills are drained by the left tributaries of the Buh River; the western slopes are drained by the left tributary of the Dniester River-- namely, the Vereshycia River -- and by numerous tributaries on the right side of the Sian River.

3. One of the glaciers in the Pleistocene age had a very important influence on the topography of the northern part of the Rostotchia Hills region; it deposited a

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large quantity of boulders, cobbles and pebbles in this area. Sand that was accumulated by the water flowing off the end moraines was also deposited here.

4. The oldest rocks identified in the drillings on the Buh River Plain were limestones, sandstones, sands, and shales in which traces of coal were found. These sediments are of the Carboniferous age. The surface configuration of these rocks dips downward in a southwesterly direction toward the Subcarpathian Piedmont, where Tertiary sediments of great thickness are partly covered by the external Carpathian folds.

5. The Carboniferous rocks are covered by the limestones of the Senonian formation of the Upper Cretaceous age. When fresh, these limestones have a greenish-gray color; after they are weathered, the color becomes more yellow. The thickness of the Senonian limestones in one drilling in the vicinity of Lwow was 470 meters (about 1542 feet); in the vicinity of Zholkva and Rava Ruska, it is probably even larger. During the Early Tertiary -- Paleocene, Eocene, and partly Oligocene epochs -- the Rostotchia region was an area with numerous streams and rivers which eroded its bedrock.

6. The next transgression of the sea on this territory occurred during the Upper Oligocene epoch. This sea deposited a greenish (or sometimes gray) clay mixed with sand and pieces of Senonian limestone. The thickness of this Upper Oligocene sediment is not large, usually ranging from 0.20 to 1.05 meters. However, the thickness of these sediments depends upon the underlying beds; in the hollows of the limestone of the Upper Cretaceous age, the thickness reaches 3.5 meters (in Monastyrok for instance), eight meters (in Potylych), or even 10 meters (in Mokrotyn).

7. Sediments of the Tortonian formation were then deposited on these Upper Oligocene sediments (or, in those areas in which the Upper Oligocene sedimentation was lacking, directly on the limestone of the Senonian formation). The Tortonian deposits include interbedded sand, clay, brown coal, sandstone and limestone. In some places (for instance, in the vicinity of Zholkva) bentonites, ranging in thickness from 30 to 40 centimeters, are found in the lower, sandy part of the Tortonian deposits. The petrographic changes of these sediments, and the character of the fauna and flora indicate that the Tortonian sea in the area of Rostotchia was shallow and quiet, and that the climate of this area was warm. Brown coal, together with dark clay, is found mostly in the lower part of the Tortonian deposits in those places where there are depressions in the underlying rocks.

8. The brown coal of this area is deposited in the form of lenses. The same phenomena can also be noticed in the northern part of Podolia, for example, in Kozaky and Buda Trostianecka near Zolochev, and in Pidhirci and Jaseniv near Olecko. Brown coal is also found in Kremanets in Volynia. In these localities brown coal is found in the lower, sandy part of the Tortonian sediments where underlying rocks of Senonian formation form small valleys.

9. Quaternary sediments are deposited on the Miocene deposits, or directly on the Senonian limestones in places where the Miocene deposits have been washed away by the post-glacial waters, as in the Sian river and Buh river basins. These sediments are composed of fragments of Senonian limestone, Tertiary rocks, glacial boulders, cobbles, pebbles and sand and loess. Loess is the most important sediment of the Quarternary deposits, since erosion of these deposits resulted in the formation of canyons, such as are to be seen near Hrubieszow, northwest of Lwow.

The Hydrographical Circumstances

10. In the Rostotchia Hills several water levels can be found: (a) between the Senonian limestone and the overlying Tertiary sediments, or in the upper part of the Senonian limestone where the surface has many cracks; (b) among the Tortonian deposits, particularly on the surface of clay beds. Water is sometimes found in limestone or sandstone of the Tortonian age. The most abundant water supply is found at the junction of the Senonian limestone with the Tertiary sediments. From this water level originate numerous springs which supply drinking water. These springs also give rise to creeks which later form rivers. The water which springs from the surface of the clay that is associated with brown coal lenses often causes a shifting of the

overlying sediments. This makes mining of the coal impossible.

Brown Coal Deposits

11. According to investigations of brown coal in Rostotchia, the deposits are located in the vicinity of Zholkva, specifically, near the villages of Hlynsko, Nova Skvariava, Mokrotyn, Fijna and Majdan Polanskyj. Deposits are also located in the vicinity of Rava Ruska near the villages of Potylych, Monastyrok and Dubrivka.

a) Hlynsko. The brown coal is deposited here in two layers in the lower part of the Tortonian sands on the northwestern slopes of the hill known as "Vovcha" (elevation.369 meters). The thickness of the lower layer is between 0.44 to 1.10 meters, and of the upper layer, between 0.05 to 0.30 meters. The lower layer is more compact, and it tapers off, being narrowest at the eastern end. The deposits of brown coal in this locality are estimated to be 45 thousand metric tons.

b) Nova Skvariava. The brown coal is deposited in the lower part of the Tortonian sands, which lie southwest of the village. The coal of this locality is found in the form of a lens, which is one kilometer long and 130 meters wide. The thickness of this layer is between 0.70 and 1.60 meters. The deposits of brown coal in this locality are estimated to be 30 thousand metric tons.

c) Mokrotyn. Deposits of brown coal are located about two kilometers southwest of this village. This coal is deposited in only one layer, in a valley about 800 meters long and 60 meters wide, in the underlying Senonian limestone. The thickness of this layer of coal reaches a maximum of 1.3 meters, but it averages 0.85 meter. Reserves of coal are estimated to be about 50 thousand metric tons. The deposits of clay which lie above this coal are impervious to water, and they therefore make the extraction of the coal easier. Small deposits of brown coal are also found in the hill known as "Hutka", which is located south of the road between Majdan and Zovkva. The thickness of this layer is 0.45 to 0.70 meter.

d) Fijna - Majdan Polanskyj. The brown coal deposits near these localities are found in the form of small lenses, which are 0.18 to 0.25 meter thick.

e) Monastyrok. Brown coal is located on the hill between the Murusia Creek, on the north, and the Doroshykha Creek, on the south. The coal of this area is deposited in two layers. The upper layer is more compact; its thickness is between 0.5 to 2.7 meters. The lower layer consists mostly of thin lenses, separated from each other by sand. The upper layer is associated with clay. In places where the overlying clays are mixed with sand, which formation permits the passage of water, the extraction of the coal is very difficult. In a few places the upper layer of coal is subdivided by sand or clay into two beds; the thickness of the upper is 0.15 to 0.55 meter; of the lower, at the western end, 0.45 to 1.8 meters. In the eastern part of this coal area, the lower bed reaches a thickness of two meters. The reserves of brown coal in Monastyrok are estimated to be 421 thousand metric tons. Its calorific value is between 2391 and 3859 per ton.

f) Dubrivka. The brown coal of this locality is located about one kilometer northwest of the Monastyrok coal area. It is deposited in two layers. The upper bed is usually associated with dark clays, while the lower bed is divided by sand, as in the Monastyrok area. The reserves of brown coal near Dubrivka are estimated to be about 60 thousand metric tons.

g) Potylych. Here brown coal is found mainly on the hill known as "Nyva". Here, also, the deposits occur in two layers, the upper layer being about 1.5 meters

thick, and made up of many small lenses. The thickness of the lower layer is the same as the upper, but is less compact. The reserves of brown coal in this locality are estimated to be 47 thousand metric tons. The calorific value of this coal is between 2400 and 3800 per ton.

Summary of Value

12. Three important disadvantages of the Rostotchia brown coal are that (1) it produces a great amount of ash, 23 to 40 percent generally and sometimes as much as 53 percent; (2) its moisture content is 18 to 27 percent; and (3) it contains a considerable amount of sulphur, which, upon burning, is converted into hydrogen sulfide. Furthermore, utilization of these deposits is considerably lessened by the lack of good transportation. However, since better grades of coal are lacking in this part of the Ukraine, these deposits are of great importance. Future geological investigation must be awaited to learn whether or not a better bituminous coal exists in the sediments of the Carboniferous age in this western part of the Ukraine.

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